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A molecule that has been spreading emotions for millions of years

Fish copy emotions just like humans, a study shows. The responsible molecule is oxytocin.

Oeiras, March 23th, 2023 – Gulbenkian researchers reveal that zebrafish use similar mechanisms to those of humans to read and mimic emotions. The discovery, published in **Science**, could transform the study of the brain and of this social behavior that is crucial for our well-being.

When someone smiles at us, we tend to smile back. On the other hand, if we spend time with someone who is mad or stressed, we end up absorbing these negative emotions. This tendency to align with the emotions of others is called emotional contagion. This basic form of empathy has been programmed in our brain for thousands of years and it is not difficult to get why. When there is a threat, this phenomenon allows fear to spread quickly, increasing the chances of survival. Besides, by mimicking emotions, we establish social bonds with others.

But this behavior is not exclusive to humans. New data from the Instituto Gulbenkian de Ciência (IGC) confirm that the mechanisms we use to synchronize emotions go back to the most ancient group of vertebrates, fish.

In their most recent work, the IGC team led by **Rui Oliveira** tried to understand if, similarly to humans and other mammals, zebrafish need oxytocin to adopt others' emotions. The experiments they carried out showed that, when fish similar to those found in nature see a shoal in distress, they mirror their behavior. On the other hand, fish with genetic alterations either on oxytocin or its receptors keep swimming normally even when they see their conspecifics in distress. This shows that this molecule is necessary to spread fear, for instance, when one of the shoal's members is hurt.

But how can we be sure that fish are recognizing fear in their conspecifics and not simply copying their behavior? "We realized these observers approach the distressed shoal even when it gets back to swimming normally, whereas mutated fish prefer to be close to the group that had always been in a neutral state", explains **Kyriacos Kareklas**, a postdoc at the IGC and co-first author of the paper. This means that, via oxytocin, zebrafish decode and mimic the emotional state behind the neighboring shoal's movements and start behaving in a similar way.

It is impressive that fish get close to the distressed shoal, given that, in nature, this could mean that a predator is nearby. Although it puts them at risk "being approached by conspecifics could help the group recover from stress", the researcher clarifies. These other-oriented acts are well-described in mammals, where they are also regulated by oxytocin.

But oxytocin is not the only common factor between fish and humans regarding emotional contagion. "To recognize and match emotions, zebrafish use areas of the brain that are equivalent to some of those that humans also use for this purpose", the principal investigator Rui Oliveira explains. This makes these fish the perfect model to study this social behavior and its neural mechanisms. This way, these findings lead the way towards understanding how we are affected by others' emotions and how this shapes our well-being and society, with implications that go from public health and politics to marketing.

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